

# **Social Cognition in Schizophrenia:** Relations between ToM Impairments and Symptoms

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*"Can you read my thoughts?" she asked them.*

*"Are you talking to me?" Lee said.*

*"To all of you. Can you read my thoughts?"*

*"What are you trying to do - get me sent to seclusion?"*

*"Go to hell", Helene said pleasantly.*

*"Don't look at me," Miss Coral said, with the genteel horror of a countess visiting an abattoir.*

*"I can't even read my own."*

From "I Never Promised You a Rose Garden" by Joanne Greenberg

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# Abstract

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**Title:** Social Cognition in Schizophrenia: Relations Between ToM Impairments and Symptoms

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**Background:** Social cognition in schizophrenia has received increasing interest over the last decade because of its role as an important determinant of functioning. However, one lacks a clear understanding about how social cognition abilities relates to the clinical symptomatology of schizophrenia. The aim of this study was to investigate one well-established domain of social cognition, Theory of Mind (ToM), and its associations to symptoms in a group of persons with schizophrenia. Specifically, the study aimed to explore whether the ToM deficits of “undermentalizing” and “overmentalizing” could be related to negative/disorganized symptoms and positive symptoms, respectively.

**Methods:** The 52 participants were all recruited from the Norwegian Center for Mental Disorders Research (NORMENT) study of Oslo Universitetssykehus. The measurement chosen for ToM ability was Movie for the Assessment of Social Cognition (MASC), and the Positive and Negative Syndrome Scale (PANSS) was used to assess clinical symptoms.

The student participated in the collection and punching of data through work as a research assistant at NORMENT, and has also performed all statistical analyses presented.

**Results:** Bivariate correlation analyses revealed a moderate, significant correlation between overmentalizing and positive symptoms. No significant correlations were found between undermentalizing and negative/disorganized symptoms. Results may indicate that only overmentalizing problems are state dependent in schizophrenia, whereas undermentalizing may be more of a trait marker.



# Preface and acknowledgements

My interest in schizophrenia was first awakened when I started working at a hospital ward for people with various psychotic symptoms at the beginning of my study. I experienced how these persons suffered in different ways from their disease – and I also noticed how everyday social communication became difficult for some. The result was often withdrawal, anxiety and isolation. This made me conscious of how important these abilities are; to read other people's faces, to understand the unspoken, to interpret the intentions of others.

The enthusiasm for this patient group has developed and grown stronger through my studies, and I was never in doubt that my master thesis would have to be on schizophrenia. It was therefore with great excitement I started this work, in which I have been given the opportunity to study closer the social cognitive difficulties that sometimes follow schizophrenia. As a future clinical psychologist, I have strong faith in the treatment potential of this domain. To be able to communicate with your surroundings is a foundation in every human being's life.

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First of all, I wish to thank NORMENT for letting me use their participants in this work.

I am most grateful to my principal supervisor Anja Vaskinn for engaged and professional supervision throughout the whole process – her ability to ask the important questions and stimulate new thoughts has been invaluable.

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# 1 Introduction

## 1.1 Schizophrenia and its symptoms

Schizophrenia is the most debilitating and costly of all adult mental disorders (Combs & Mueser, 2007). According to the World Health Organization, schizophrenia affects about 24 million people worldwide, and approximately 25% of all psychiatric hospital beds are occupied by persons affected by the disorder. The latest figures of national costs connected to schizophrenia in Norway show an estimate of 4 billion NOK in yearly expenses (Rund, 1995), and it is presumed to cost the Norwegian society more than both heart diseases, cancer and rheumatologic disorders together (Johannessen, 2011). Many persons suffering from schizophrenia are likely to experience multiple episodes of acute symptomatology, causing severe long-term functional impairment, and relapse can be expected in 70% of patients after the first episode (Müller, 2004). However, full recovery is possible (Torgalsbøen & Rund, 2002).

Three major groups of symptoms are apparent in the disease. These include positive symptoms, negative symptoms and cognitive impairments.

### 1.1.1 Positive symptoms

Positive symptoms refer to thoughts, sensory experiences, and behaviors that are present in persons with schizophrenia, but are ordinarily absent in healthy persons. Common examples include hallucinations (hearing voices, seeing visions), delusions (e.g. feeling persecuted), and bizarre, disorganized behavior (Combs & Mueser, 2007). Persecutory delusions are the most common type of delusion found in schizophrenia (Appelbaum, Robbins & Roth, 1999). A combination of thought disturbances, affect disturbances and bizarre behavior is often referred to as “disorganization” (Johannessen, 2011). The positive symptoms tend to fluctuate over the course of the disorder, are often in remission between episodes of the illness, and are more responsive to antipsychotic medication than the other symptom groups of schizophrenia (Opjordsmoen, 2011).

Specific measurements of positive symptoms include the Scale for the Assessment of Positive Symptoms (SAPS). However, clinicians often measure both positive and negative symptoms at the same time using instruments like the Positive and Negative Syndrome Scale (PANSS; Kay, Fiszbein & Opler, 1987) or the Brief Psychiatric Rating Scale (BPRS; Ventura et. al., 1993; Ventura & Marder, 2012). The specific positive symptom items measured by the widely used PANSS interview are delusions, conceptual disorganization, hallucinatory behavior, excitement, grandiosity, suspiciousness and hostility. The PANSS items are sometimes used in different combinations to assess a person's symptom profile, and in more recent literature, it is common to use one of several empirically derived factor models of PANSS to assess both positive symptoms, negative symptoms and symptoms of disorganization (Langeveld et. al., 2013).

### **1.1.2 Negative symptoms**

Negative symptoms refer to the absence or diminution of cognitions, feelings or behaviors ordinarily present in persons without the illness. Typical negative symptoms in schizophrenia include blunted or flattened affect, anhedonia, apathy, and psychomotor retardation (Combs & Mueser, 2007).

The most current research on negative symptoms suggests that patients with different types of negative symptoms can be divided into subgroups with different clinical presentations. Strauss et. al. (2013) found two distinctive negative symptom subgroups; one with predominantly Avolition-Apathy (AA) symptoms, and another with a predominantly Diminished Expressions (DE) profile. AA and DE subgroups differed on factors like functional outcome, social cognition and clinical course, with the AA group being associated with poorer outcome than the DE group. The newly developed instrument Clinical Assessment Interview for Negative Symptoms (CAINS) measures a variant of these two subscales, labeled "Motivation/Pleasure" and "Expression". CAINS went through its final validations in 2013, and is now a recommended measure (Kring et. al., 2013).

However, PANSS is still widely used to assess negative symptoms. Items being assessed here include blunted affect, emotional withdrawal, poor rapport, passive-apathetic

social withdrawal, difficulty in abstract thinking, lack of spontaneity and flow of conversation, and stereotyped thinking.

While positive symptoms and symptoms of disorganization often appear in the acute phase of the disorder, the negative symptoms tend to develop later in the course. In a more chronic development of the disorder, the negative symptoms tend to be stable over time, resistant to medical treatment and impede functional recovery in schizophrenia (Kring et. al., 2013).

### **1.1.3 Cognitive impairments**

The focus on cognitive impairments in schizophrenia has increased over the last decades, although described by both Kraepelin and Bleuer already early in the 20<sup>th</sup> century. Cognitive impairments refers to affected persons' difficulties in verbal and visual learning and memory, working memory, attention and vigilance, abstract reasoning, executive functioning and speed of information processing (Green et. al., 2004). Neurocognitive deficits have been observed in un-medicated, medicated, first-episode and remitted adults as well as high-risk children prior to developing the disorder; thus cognitive impairments are so commonplace that they are now considered a core feature of schizophrenia (Wilk et. al., 2005). Similar difficulties have also been found when studying adolescence with schizophrenia spectrum disorders (Ueland et. al., 2004; Holmén et. al., 2010). A meta-analysis of cognitive performance by Heinrichs (2005) found that healthy control participants consistently perform about one standard deviation better than persons with schizophrenia on most cognitive tasks. Without rehabilitation efforts, the cognitive deficits also appear to be relatively stable over time, although follow-up studies suggest a decline (Øie, Sundet & Rund, 2010; Barder et. al., 2013). Underlining its clinical importance, a large body of cross-sectional as well as longitudinal studies provides empirical evidence for a close link between neurocognition and functional outcome in schizophrenia. (Green et. al., 2000; Green, Kern & Heaton 2004).

Cognitive impairments are of considerable importance in schizophrenia when studied on a group level. It is, however, important to bear in mind that such deficits are not present in all individuals with schizophrenia. A study of persons with schizophrenia found about one-third of the group to have intact cognitive abilities, while 45% showed mild cognitive

difficulties and 15% severe cognitive impairments when compared to healthy controls (Rund et. al., 2005).

Because of the strong connection between cognitive impairment and functional outcome in schizophrenia, the American National Institute of Mental Health's (NIMH) initiated the Measurements and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) project. The aim of the initiative was initially to stimulate cognition-enhancing drugs for schizophrenia. It also led to the development of a consensus battery of measuring cognition in schizophrenia (Marder & Fenton, 2004). Since deficits in social cognition are commonly found in schizophrenia along with difficulties in the non-social neurocognitive domains, the MATRICS consensus battery included social cognition as one of seven domains that should be routinely assessed in clinical trial studies of schizophrenia (Green et. al., 2004).

## **1.2 Social cognition in schizophrenia**

Social cognition has become a rapidly growing area of schizophrenia research, with the number of publications devoted to the topic increasing substantially since the turn of the century (Green & Horan, 2010). Fueling the interest is a convergence of data indicating social cognition's close link to functional outcome, and an early review article from 2006 concludes that there are clear and consistent relationships between aspects of functional outcome and social cognition in schizophrenia (Couture, Penn & Roberts, 2006; see more in chapter 1.3).

### **1.2.1 Social cognition**

Social cognition refers to how people think about themselves and others in the social world. The term is used in different fields of psychology, and several definitions have been proposed. Most of them state that social cognition is a set of related neurocognitive processes applied to the recognition, understanding, accurate processing, and effective use of social cues and information in real-world situations (Penn et. al., 1997). A consensus meeting on social cognition in schizophrenia held by the NIMH in 2006 agreed upon defining social cognition as "the mental operations that underlie social interactions, including perceiving, interpreting

and generating responses to the intentions, dispositions and behaviors of others” (Green et. al., 2008).

Social psychology usually divides social cognition into four core processes that human beings use to make sense of the world. These four are *attention* (what information do you select?), *interpretation* (what meaning to you give the information?), *judgment* (how do you use your information to make decisions?) and *memory* (how do you store your information for future use?) (Kenrick, Neuberg & Cialdini, 2007). Put together, these processes help us navigate in the complex social world.

### **1.2.2 The different domains of social cognition in schizophrenia**

The most commonly studied areas of social cognition in schizophrenia research, defined by the NIMH consensus, include (a) emotion processing, (b) social perception, (c) social knowledge, (d) attributional bias and (e) Theory of Mind (ToM). Some researchers use only four categories, including “social knowledge” in the “social perception” domain (Couture & Penn, 2013). The boundaries between these categories are not absolute, and there is a considerable overlap between the terms (Green et. al., 2008). The four first categories will here be described briefly, before a more thorough exploration of the ToM domain, as ToM is the focus of this empirical work.

*Emotion processing* refers broadly to perceiving and using emotions (Green et. al., 2008). Tasks may test the ability to understand what another person is feeling from facial expressions, vocal inflections, body movements, or a combination of these, or they may include expressing of emotions (Philips & Seidman, 2008). This category also encompasses the area called “emotion/affect perception” (Couture & Penn, 2013). A commonly used test of emotion processing in schizophrenia is the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT), which is also the social cognition test chosen to be part of the MATRICS consensus battery (Green et. al., 2004). An extensive body of literature has documented that emotion processing is altered in schizophrenia (Kohler, Hanson & March, 2013).

Tests of *social perception* assess a person’s ability to identify social roles, societal rules, and social context. Typically, participants are faced with ambiguous or complex social

situations, and must use different cues to make inferences about the situation. This ability is thought to be central to functioning in a social context.

The category *social knowledge* is also sometimes called *social schema*, and refers to the representational templates of social situations. It typically tests one's awareness of what is socially expected in different situations (e.g., in a doctor's office versus in a restaurant) (Green et. al., 2008).

*Attributional style* reflects how people usually infer the causes of particular positive or negative events, typically if one tends to think that something is caused by internal, external or situational factors.

*ToM*, also referred to as mentalizing or mind-reading, refers to the ability to infer the intentions, dispositions and beliefs of others (Green & Horan, 2010). The term was first used by primatologists and psychologists Premack and Woodruff, who found that the chimpanzee possessed abilities similar to humans when it managed to impute mental states to itself and others (Premack & Woodruff, 1978). Developmental psychologists studied at what age normal children develop ToM abilities, and in the 1980s and 1990s, the most extensive ToM studies were carried out in patients with autistic spectrum disorders (e.g. Baron-Cohen et. al., 1985) and in adult patients with frontal lobe damage (e.g. Rowe et. al., 2001).

In the early 1990s, researchers began investigating possible associations between ToM ability and schizophrenia. Today, a large body of research confirms that ToM is disrupted in patients with schizophrenia (Abu-Akel & Shamay-Tsoory, 2013). Furthermore, recent meta-analyses and literature reviews have showed that such impairments appear to be *specific*, and not due to some executive functioning deficit, general cognitive impairment, or the presence of general psychopathology (e.g. Bora, Yucel & Pantelis, 2009; Brüne, 2005). Harrington, Sigert & McClure conclude in their review (2005) that the evidence stands strongly in support of a ToM deficit in schizophrenia that cannot be accounted for by other factors. In their meta-analysis of 29 studies of ToM in schizophrenia, Sprong et. al. (2007) found significant and stable ToM impairments in schizophrenia, with the average ToM performance of participants with schizophrenia being more than one standard deviation below that of healthy controls.

ToM tasks have been found to vary in form and content. Two meta-analyses have subdivided ToM tasks into multiple categories, ranging from four (Sprong et. al., 2007) to seven (Bora et. al., 2009). A much used way of testing ToM has been the Reading the Mind in



the Eyes task by Baron-Cohen et. al. (1997). This task requires that one infers the mental state of a person only by looking at a photograph of the person's eyes. Other commonly used tasks in this area involve responding to questions about brief social vignettes, or arranging cartoon panels into a sensible order to demonstrate one's understanding of perspective taking, nonliteral language like sarcasm, or deception (Green & Horan, 2010).

Several of the ToM tasks have, however, been criticized for being static and low in ecological validity due to their distinctness from real-life social situations. There has therefore been a request for researchers to develop more sophisticated approaches, focusing on better resemblance to real situations (Couture & Penn, 2013). Mehl et. al. (2010) stated that it is necessary to use movie-based tasks that portray social situations instead of the more traditional tasks with verbal vignettes and static pictures when assessing ToM. The authors argued that movies can give participants information about character's emotional state, facial expression and gestures at the same time. A study from 2007 concluded that ToM tasks based on more ecological stimuli like video excerpts are powerful in detecting ToM abnormalities in patients with schizophrenia (Bazin et. al., 2007) Using more real-life ToM tasks may be especially important given the important role social cognition seems to play in human functioning.

### **1.3 Social cognition and functional outcome in schizophrenia**

As previously mentioned, impairments of the traditional neurocognitive domains like memory, attention, IQ and executive functions have for many years been regarded an important determinant for functional outcome in people with schizophrenia. Despite significant associations between neurocognition and functional deficits, however, the correlation have been found to be moderate, with neurocognition accounting only for 20%-60% of the variance in functional outcome (Green, Kern & Heaton, 2004). This has yielded the search for mediators that may shed further light to the mechanisms at work in the relationship between neurocognition and functional impairments. Social cognition has now been established as a contributing mediator (Couture, Penn & Roberts, 2006).

Two broad studies investigated social cognition's role in functional outcome. Schmidt et. al.s' empirical review (2011) found that social cognition mediates a significant indirect relationship between neurocognition and functional outcome, with an average 25% of the variance in functional outcome being explained in the mediation model. Fett et. al. (2011) discovered in their meta-analysis that social cognition was more strongly associated with community functioning than neurocognition, with the strongest associations among the social cognitive domains being between ToM and functional outcome. However, they also found that three-quarters of the variance in outcome was left unexplained. In a study of 178 individuals with schizophrenia spectrum disorders, Couture et. al. (2011) found that ToM specifically served as an important mediator between neurocognition and social competence. Vaskinn et. al. (2008) did similar findings in a Norwegian patient sample, where emotion perception was seen to be a mediator between neurocognition and functional outcome.

The exact relationship between neurocognition and social cognition with regards to functional outcome is not yet fully understood. Much evidence points to the direction of them being two related but distinct factors (e.g. Sergi et. al., 2007). A recent study investigating the causal relationship between the factors found strong support for a model where neurocognition underlies social cognition, and, at the next level, that neurocognition *and* social cognition are causally primary to functional outcome (Hoe et. al., 2012).

### *Consequences for treatment*

With all this research supporting social cognition's important role in functional outcome, both as a mediator and as an individual factor, the question of clinical implications has become central. Is it possible to enhance social cognition in persons with schizophrenia, and thereby increasing their real-world functioning and life quality? Psychosocial treatments have yielded most interest, since some studies have showed that medication has not been successful in improving social cognition abilities in persons with schizophrenia (Penn, Sanna & Roberts, 2008; Harvey et. al., 2006). Emerging evidence indicates that performance on social cognitive tasks is indeed amenable to psychosocial intervention techniques (Kurtz & Richardsson, 2012), and that both broad-based and more targeted treatments can lead to improvements in functional outcome (Roberts & Velligan, 2012; Horan et. al., 2008).

Among the most commonly used broad-based treatment programs today, are Cognitive Enhancement Therapy (CET), Integrated Neurocognitive Therapy (INT), Metacognitive Therapy (MCT), and Social Cognition and Interaction Training (SCIT). The SCIT program, for example, targets emotion perception, ToM and attributional style, lasts 20-24 weeks, and has shown improvement in both inpatients and outpatients with schizophrenia, with lasting results at 6-months follow up studies (Combs, Torres & Basso, 2013).

Also more targeted interventions modifying only one of the social cognitive domains have shown effect. Mazza and colleagues (2010) compared changes in ToM performance in patients with schizophrenia following 12 sessions of the Emotions and ToM Imitation Training program (ETIT). Compared to the control conditions, the patients randomized to ETIT evidenced improvements in several ToM measures, affect recognition, empathy, clinical-rated social functioning and positive symptoms. Affect perception has also proven to be modifiable in people with schizophrenia through the Training in Affect Recognition (TAR) program, with lasting long-term effects (Wolwer & Frommann, 2009).

## **1.4 Associations between symptoms and specific ToM impairments**

The promising findings referred to in the previous section give good reason to believe that psychosocial interventions targeting social cognition may lead to improvements in functional outcome for persons with schizophrenia. Given the heterogeneity of this group, however, it could be expected that the social cognition treatment ideally should be tailored individually to each person's needs. It would at least be helpful to find patterns within the patient group that could give the clinician an indication of what kind of social cognition challenges the patient most likely is facing. As symptoms are routinely assessed in this patient group, it can be fruitful to explore whether it is possible to link certain symptom profiles in schizophrenia to specific social cognition impairments.

### 1.4.1 Frith's model

In 1992, Chris Frith proposed a relationship between specific symptoms of schizophrenia and ToM impairment. This initial model put ToM at the forefront in understanding schizophrenic pathology in terms of both positive and negative symptoms. According to Frith, patients who have difficulties in representing their own or other's mental state ("disorders of willed action") would experience negative symptoms or symptoms of disorganization. Patients with positive symptoms were presumed to have an underlying deficit in self-monitoring, causing them to misattribute self-generated actions to an external agent (Frith, 1992, p. 73). Like persons with negative symptoms, they were expected to show a ToM deficit compared to control persons, but their impairment was hypothesized to be less severe, as they were presumed to have some representation of other people's mental state. Remitted patients with no current signs of symptoms were expected to score similar to control persons on ToM tasks. The implication of intact ToM in remitted patients would in Frith's view be that ToM impairment in schizophrenia is a state of the disease, not a trait.

Some empirical evidence supports Frith's state perspective. Pickup and Frith (2001) found clear differences in ToM performance between patients with behavioral (negative/disorganized) symptoms and patients with only passivity symptoms or symptoms in remission. Corcoran et. al. (1995) found symptom specific ToM deficits in their patient group. However, Frith's model has been criticized for its hierarchical approach, since patients often report positive and negative symptoms at the same time (Abu-Akel & Shamay-Tsoory, 2013).

A different approach suggests that ToM impairment in schizophrenia is associated with abnormal ToM development, and therefore likely to be a trait of the disease (Herold et. al., 2002). The trait perspective is supported by findings of mentalizing problems in remitted patients (Bora et. al., 2008) and nonpsychotic first-degree relatives of persons with schizophrenia (Irani et. al., 2006). It seems fair to suggest that there exists evidence indicating ToM impairments in schizophrenia to be influenced by both state and trait variables. According to Pousa, David & Ruiz (2008a), methodological challenges leave the "trait or state" debate open, and conclusions should remain tentative.

Frith (2004) later specified his hypothesis and proposed a further differentiation between ToM errors performed by persons with predominantly negative compared to patients with predominantly positive symptoms. He suggested that the problem of patients with

negative or disorganized symptoms is that they lack a functional concept of mental states such as beliefs or intentions. He labeled this impairment “undermentalizing”. Patients with positive symptoms like paranoid thoughts, on the other hand, would according to Frith tend to “overmentalize”. By this, he meant a tendency to excessively attribute intentions or self-referential meaning to others, and therefore predict behavior on erroneous beliefs. Frith called for ToM tasks distinguishing between under- and overmentalizing errors to test this hypothesis and to get a better insight in the types of ToM errors persons with schizophrenia actually are performing. He encouraged further research in this area, stating that “whether there is a special relationship between mentalizing problems and symptoms remains unclear” (p. 386).

#### **1.4.2 Recent studies investigating the association between symptoms and ToM impairments**

Since Frith’s proposal in 2004, the association between ToM abilities and positive, negative and disorganization symptoms of schizophrenia have been examined in several studies. Sprong et. al.’s meta-analysis (2007) revealed that the participants with symptoms of disorganization had significantly lower ToM scores than those in other symptom subgroups. Ventura et. al.’s meta-analysis of 154 studies (2013) showed moderate associations between ToM ability and disorganization symptoms ( $r$ ’s range from -.22 to -.32) and negative symptoms ( $r$ ’s range from -.20 to -.26), whereas the relationship between ToM and positive symptoms (delusions, suspiciousness, hallucinations) was minimal.

In smaller samples, Lincoln et. al. (2011) found a significant association between ToM difficulties and negative symptoms in their group of 75 patients. Similarly, Urbach et. al. (2013) found ToM performance to be correlated with disorganization symptoms and negative symptoms in their sample of 206 patients with schizophrenia. Abdel-Hamid et. al. (2009) found a significant association between a general ToM deficit and disorganization symptoms among their 50 patients.

Other findings suggest that symptoms and ToM ability are independent dimensions. A study by Mancuso et. al. (2011) found no significant correlation between scores on social

cognition tasks including the ToM domain and clinical symptoms. Roncone et al. (2002) and Russell et. al. (2006) found no association of positive or negative symptoms with ToM performance in their samples.

Worthy a special emphasis is the fact that a substantial amount of studies report no or small correlations between positive symptoms and impaired ToM ability (e.g. Ventura et. al., 2013; Urbach et. al., 2013; Abdel-Hamid et. al., 2009), in contrast to Frith's hypothesis. However, Frith's question as to whether more sensitive measures of ToM could have yielded other results, remains unanswered.

In 2006, Dziobek et. al. introduced the Movie for the Assessment of Social Cognition (MASC). This new tool involved watching a film and answering questions referring to the actors' mental states. The scoring differentiated between types of errors: "exceeding ToM" (overmentalizing), "reduced ToM" (undermentalizing) and "no ToM" (lack of a mental state concept). Montag et. al. (2011) applied MASC in a study of 80 patients diagnosed with paranoid schizophrenia and 80 matched healthy controls. They found that the patient group had significantly lower overall MASC scores than the healthy controls, in line with previous evidence of impaired ToM in schizophrenia. Perhaps more interestingly for our purposes, the error analysis of the schizophrenia sample showed associations between errors types and symptoms. There was a significant correlation between "overmentalizing" and positive symptoms, and there was a significant correlation between "no ToM" answers and negative scores. Findings were interpreted as support for Frith's theory that there exists a relation between various schizophrenia symptoms and different kinds of ToM impairments. However, as few studies have examined this differentiation between types of ToM deficits, the results must be regarded as preliminary.

## **1.5 Aims of this study**

Building on Frith's revised model (2004) and recent studies on the relationship between ToM impairments and the positive and negative symptoms of schizophrenia, this study aims to investigate these associations in a Norwegian patient sample. Using MASC as a measure of ToM ability, and PANSS as a measure of schizophrenia symptoms, the study will examine the

relations between the types of ToM errors performed by the participants and the positive symptoms, negative symptoms and disorganization symptoms they express.

A number of studies indicate that ToM abilities could be highly variable within and among individuals with schizophrenia (Abu-Akel and Shamay-Tsoory, 2013). There is some evidence suggesting that undermentalizing is associated with negative symptoms and overmentalizing is associated with positive symptoms, but, according to Abu-Akel and Shamay-Tsoory, this distinction should be reviewed with caution, awaiting further research. To examine these individual differences more closely is the exact purpose of this work. It will be of particular interest to see whether Frith's hypothesis; that different symptom profiles are associated with differentiated ToM deficits, will be supported, since this hypothesis hardly has been tested with appropriate error sensitive measures before (Montag, 2011).

Abu-Akel and Shamay-Tsoory also encourage researchers in the field to separate component processes of ToM in schizophrenia, claiming this to be crucial to gain better insight into the nature and extent of the impairment. MASC will allow such refined analyses of ToM ability in this study. Ventura, Wood and Helleman (2013) state in their meta-analysis that

“Despite all that is known about symptoms, we lack a needed understanding of the relationship between major symptom dimensions such as reality distortion, disorganization and negative symptoms, and the domains of social cognitive processes. (...) Finding a link between symptoms and social cognitive processes could help broaden our understanding of these important relationships and guide the development of social training programs.”

Hence, the study will contribute to the ongoing debate on if and how different symptom profiles in schizophrenia relate to ToM impairments. A novel, video-based instrument will be used for the first time in Norway. To our knowledge, this is also the first time the associations between symptoms and differentiated ToM ability as measured with MASC will be assessed using a five-factor model of the PANSS (Wallwork et. al., 2012), in line with the most recent literature in the field (Langeveld et. al., 2013).

### 1.5.1 Hypotheses

The study's two first hypotheses are based on the above mentioned literature (Ventura et. al., 2013; Urbach, 2013; Lincoln et. al., 2011; Abdel-Hamid, 2009; Sprong et. al., 2007) on the associations found between symptom groups and a generalized ToM deficit. The two last hypotheses will test Frith's revised model (2004), and are also based on Montag's (2011) findings, assessing whether a more sophisticated and ecologically valid error measure like MASC will be able to detect differences in ToM error types associated to symptoms. The hypotheses will therefore be as follows:

#### **General ToM performance**

*1a) There will be a positive correlation between disorganization symptoms and general ToM impairment*

*1b) There will be a positive correlation between negative symptoms and general ToM impairment*

#### **Specific ToM error types**

*2a) There will be a positive correlation between disorganization symptoms and undermentalizing errors*

*2b) There will be a positive correlation between negative symptoms and undermentalizing errors*

*2c) There will be a positive correlation between positive symptoms and overmentalizing errors*



## 2 Method

### 2.1 Participants

Fifty-two Norwegian-speaking participants (33 males, 19 females) with a DSM-IV diagnosis of either schizophrenia or schizoaffective disorder (schizophrenia:  $n=38$ , schizoaffective:  $n=14$ ) were included in the study. It is rather common to combine participants from these two diagnostic groups in neuropsychological literature on schizophrenia, as little or no difference is found between them in terms of non-social or social cognition (Sergi et. al., 2007; Simonsen et. al., 2011; Fiszdon et. al., 2007; Goldstein et. al., 2005). All were participants in the Norwegian Center for Mental Disorders Research (NORMENT) study. They were recruited from the Division of Psychiatry at Oslo University Hospital, and Akershus University Hospital.

Inclusion criteria were a DSM-IV diagnosis of schizophrenia or schizoaffective disorder,  $IQ>70$ , and either Norwegian as mother tongue or all compulsory schooling conducted in Norway. Exclusion criteria were present or past neurological diseases, such as epilepsy, or previous head trauma causing hospitalization. Three participants did not use medicines, the rest were on various antipsychotic medication. All neuropsychological tests were administered within two weeks of the clinical assessments.

Diagnosis was based on the Structured Clinical Interview for DSM-IV (SCID-I, First et. al., 1995), and all clinical assessment was carried out by trained psychiatrists and clinical psychologists. The mean age was 28.8 years (18-51 years). Mean IQ level as measured by the “Vocabulary” test and the “Matrix Reasoning” test from Wechslers Abbreviated Scale of Intelligence (WASI) was 99.7 (IQ points 73-123, standard deviation: 13.4). The IQ scores were normally distributed among participants.

The participants underwent the regular research protocol at NORMENT. It consists of clinical measures, somatic examinations as well as a comprehensive neuropsychological battery including social cognitive tests. Informed consent was signed by all participants. The study has been approved by the Regional Committee for Medical Research Ethics and the Norwegian Data Inspectorate.

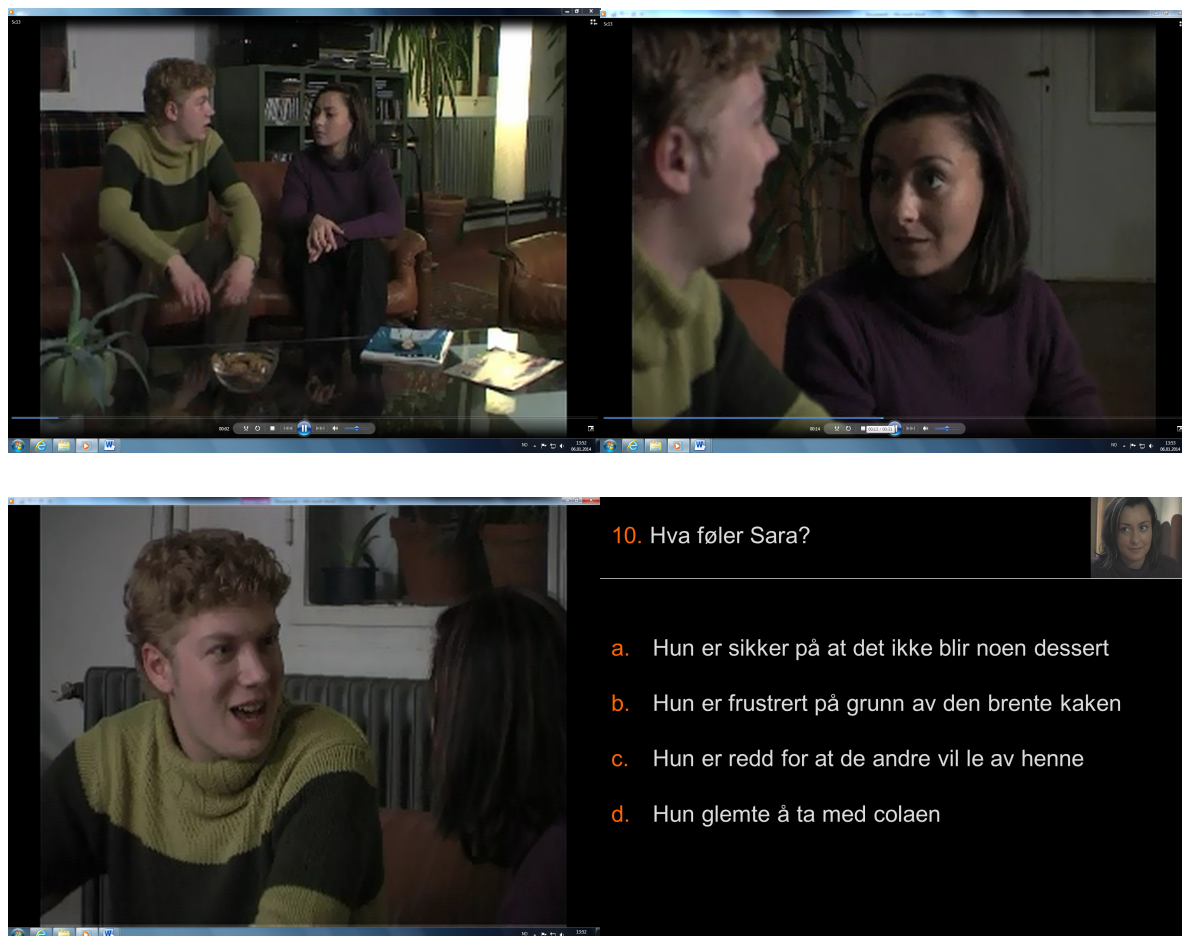
**Table 1:** *Demographic data*

|                                 |   |
|---------------------------------|---|
| <b>Sex</b>                      | 33 males<br>19 females  |
| <b>Age</b>                      | Mean: 28.8<br>(range 18-51)   |
| <b>Years of education</b>       | Mean: 11.5 years<br>(range: 4-17, $\pm 2.5$ , 4 missing)                    |
| <b>Medication</b>               | Mean: 1.2 times recommended dose<br>(range: 0,0-6,7, $\pm 1.1$ , 1 missing) |
| <b>IQ (WASI)</b>                | Mean: 99.7<br>(range: 73-123, $\pm 13.4$ )                                  |
| <b>Illness duration (years)</b> | Mean: 5.7 years<br>(range: 0-29, $\pm 5.9$ , 6 missing)                     |
| <b>GAF function</b>             | Mean: 43.4<br>(range 25-68, $\pm 10.0$ , 2 missing)                         |
| <b>Living situation</b>         | 38 outpatients, 12 inpatients, 2 missing                                    |

## 2.2 ToM measure

The social cognition domain chosen for investigation was ToM, and abilities were measured by the relatively new instrument Movie for the Assessment of Social Cognition (MASC). The tool was introduced by Dziobek et. al. (2006), and the dubbed Norwegian version is translated and made available by a research group led by post.doc. Anja Vaskinn of the newly awarded Centre of Excellence, Norwegian Center for Mental Disorders Research (NORMENT).

MASC is a 15 minutes video film about two men and two women having a dinner party. The film is paused at given points, and participants answer a total of 45 multiple-choice questions. They are instructed to make inferences about what the video characters think, feel or intend in the very moment the movie is paused. In the present study, the participants were watching the movie while the administrator was sitting next to them. The administrator read the questions aloud to the participant throughout the test.



**Figure 1:** Example of a MASC scene, with dialogue between “Sara” and “Knut”, and the proceeding question and answer alternatives. Pictures are reproduced with permission of the copyright owner.

The movie is casted by professional actors to make the scenes as realistic as possible, and the Norwegian dubbing is also done by professional actors. The test considers different mental state modalities (thoughts, emotions, intentions), in addition to the classical social cognition concepts such as false belief, faux pas, metaphor and sarcasm (Dziobek et. al., 2006).

The test was first validated on adults with Asperger syndrome. It was found to discriminate well between the patient group and healthy controls, and the analysis of four

mindreading tests identified MASC as discriminating the diagnostic group most accurately (Dziobek et. al., 2006). Fleck (2007) evaluated the test and its subscales in patients with paranoid schizophrenia and Asperger syndrome, and in both investigations, MASC showed the highest discriminative power in detecting ToM deficits compared to standard social cognitive tasks. It also showed good inter-rater reliability and internal consistency. The ecological validity is considered to be high because of the video format's authenticity and the possibility for participants to pick up multiple social cues when watching the film (see also chapter 1.2.2 for more on video-based ToM tasks).

Montag et. al. (2012) administered MASC to a group of unaffected first-degree relatives of schizophrenia patients, and again the test discriminated between the relatives group and the control group. In a study of 80 patients diagnosed with paranoid schizophrenia and 80 matched healthy controls, Montag et. al. (2011) found that the patient group had significantly lower overall MASC scores than the controls that were not explained by global cognitive deficits. ToM deficits have also been found using MASC in other clinical populations, such as bipolar disorder (Montag et. al., 2010), borderline personality disorder (Preissler et. al., 2010; Sharp et. al. 2011) and unipolar depression (Wolkenstein et. al., 2011).

In 2013, the Social Cognition Psychometric Evaluation (SCOPE) study set forth to identify the best existing measures of social cognition (Pinkham et. al., 2013). MASC was nominated by an expert group along with 20 other tests to take part in the study because of its relevance in the schizophrenia research.

### *Scoring*

The scoring of MASC consists of a sum score for all questions, indicating general ToM capacity. Additionally, errors are categorized into three groups: 1) undermentalizing with two forms: a) reduced ToM or b) no ToM, or 2) overmentalizing. In the present study, the two undermentalizing scores were added to represent Frith's concept of undermentalizing. This has also been done in comparable studies (e.g. Montag et. al., 2010). Results from the detailed error analysis of the undermentalization concept (reduced ToM and no ToM) will be presented separately.

## 2.3 Clinical measure

Symptom severity among participants in the present study was assessed with PANSS. This instrument is today the most widely used scale to assess a variety of symptoms in patients with schizophrenia and other psychosis (van der Gaag et. al., 2006). The procedure, which is a structured clinical interview, was developed to provide a reliable and valid assessment of psychotic symptoms and signs (Kay et. al., 1987).

According to the original article that introduced PANSS, the interview normally takes about 40-50 minutes. Patients are encouraged to discuss their current life situation and symptoms, and questions are both open and more specific (Key et al., 1987). Items are scored on a scale from 1 (asymptomatic) to 7 (extremely symptomatic).

PANSS has 30 items grouped in three main factors: Positive Scale (7 items), Negative Scale (7 items) and General Psychopathology Scale (16 items). Since its launching in 1987, numerous factor analyses have been published (Emsley et. al, 2003), most of which suggest that a five-factor model better captures PANSS structure than the original three factors in schizophrenia samples (Wallwork et. al., 2012; van der Gaag et. al. 2006). Studies have generally supported the presence of the following five symptoms dimensions: Positive, Negative, Cognitive/Disorganized, Depressive/Emotional and Excitement (Langeveld et. al., 2013).

A recent Norwegian study examined the statistical fit of five different PANSS factor models in a first-episode, non-affective psychosis sample (Langeveld et. al., 2013). The subscales of all the evaluated five-factor models were strongly intercorrelated, supporting the existence of five factors in PANSS. The two five-factor models that retained 25 of the 30 original items (White et. al., 1997 and van der Gaag et. al., 2006) demonstrated a better statistical fit than the five-factor model that retained all 30 items (Emsley et. al., 2003). However, Wallwork et. al.'s (2012) model, which retained 20 items, demonstrated the most optimal fit.

As several well-validated factor analyses now recommend using a five-factor model of PANSS instead of the original three factors, the present study is performed in line with this. Based on Langeveld et al.'s (2013) comparison of factor structures, Wallwork et. al.'s (2012) model was chosen.

Wallwork et. al. (2012) used PANSS five-factor models reported in the schizophrenia literature to guide the construction of a new “consensus” model. Their work resulted in a model comprising 20 PANSS items categorized into five factors: (1) Positive, (2) Negative, (3) Disorganized, (4) Excited and (5) Depressed. Factor loadings for individual items were strong, and bivariate correlations between factors were small (Wallwork et. al, 2012). Only the three first factors are applied in the present analysis, as they are considered to be most relevant in testing the hypotheses of this study. These three Wallwork factors consist of the following PANSS items:

(1) **Positive symptoms:** P1 (Delusions), P3 (Hallucinations), P5 (Grandiosity) and G9 (Unusual thought content)

(2) **Negative symptoms:** N1 (Blunted affect), N2 (Emotional withdrawal), N3 (Poor rapport), N4 (Passive/apathetic social withdrawal), N6 (Lack of spontaneity) and G7 (Motor retardation).

(3) **Disorganized symptoms:** P2 (Conceptual disorganization), N5 (Difficulty in abstraction), G11 (Poor attention).

## 2.4 Statistics

Analyses were performed using IBM SPSS Statistics 20<sup>th</sup> version (2011). Preliminary analyses were performed to investigate the distribution of the sample. Tests of normality applying the Kolmogorov Smirnov Lilliefors Significance Correction showed that only one of the variables of interest (the “positive symptoms” factor) was normally distributed using these criteria. Therefore, non-parametric statistics (Spearman’s *rho*) were used to analyze the data further.

ToM function and symptoms among participants were explored using descriptive statistics. Because sex differences have been documented in some domains of social cognition (Weiss et. al., 2007; Vaskinn et. al., 2007), this was investigated with follow-up analyses.

Bivariate correlation analyses were performed to assess the relationship between symptoms and ToM ability, utilizing Spearman's *rho*. Analyses were performed first with Wallwork et. al.s' (2012) factor model of symptoms, then with the original PANSS subscales in order to be able to compare results to other relevant articles. As the original PANSS subscales do not include a disorganization symptom scale, the hypotheses relevant to disorganization symptoms were only tested with Wallwork et. al.'s factor model. In the case of any significant correlations between symptoms and ToM ability, follow-up analyses were performed to investigate the two different error types of undermentalizing provided by MASC.

As IQ has shown to correlate with ToM (e.g. Bentall et. al., 2009), this relationship was also examined by bivariate correlation analyses.

The strength of all correlations was determined according to Cohen's (1988, pp 79-81) guidelines. *P*-level was defined to 0.05 in the study, and two-tailed tests were applied for all statistical tests.

## 3 Results

### 3.1 Descriptive analyses

#### 3.1.1 ToM measure

Table 2 presents participant's MASC data. Of 45 possible correct ToM answers, participants had a mean score of 29.1. Table 3 shows the distribution of the two variations of undermentalizing error among the participants.

**Table 2:** *MASC data*

|             | <b>Total correct<br/>MASC items<br/>(max=45)</b> | <b>Undermentalizing<br/>errors<br/>(reduced/no ToM)</b> | <b>Overmentalizing<br/>errors<br/>(too much ToM)</b> |
|-------------|--|---|--|
| <b>Mean</b> | 29.1 ( $\pm 7.3$ )                               | 10.8 ( $\pm 6.0$ )                                      | 5.1 ( $\pm 3.3$ )                                    |

**Table 3:** *MASC data with number of undermentalizing errors*

|             | <b>Reduced ToM<br/>(undermentalizing)</b> | <b>No ToM<br/>(undermentalizing)</b> |
|-------------|---|--------------------------------------|
| <b>Mean</b> | 6.8 ( $\pm 3.9$ )                         | 4.0 ( $\pm 2.6$ )                    |



### 3.1.2 Clinical measure

Table 4 shows symptom scores among participants, as measured with Wallwork's five-factor model of PANSS. To be able to compare clinical data to other relevant studies, symptom information as measured with the original PANSS subscales is also provided in Table 5 (for a brief discussion, see chapter 4.1).

**Table 4:** *Symptom scores, measured by Wallwork et. al.'s (2012) factors*

| Symptom scores<br>(Wallwork) | Maximum possible<br>score | Mean (SD)          | Range |
|------------------------------|---------------------------|--------------------|-------|
| <b>Positive factor</b>       | 28 (4 items)              | 10.5 ( $\pm 3.9$ ) | 4-18  |
| <b>Negative factor</b>       | 42 (6 items)              | 11.9 ( $\pm 5.8$ ) | 6-34  |
| <b>Disorganized factor</b>   | 21 (3 items)              | 5.8 ( $\pm 2.8$ )  | 3-19  |

**Table 5:** *Symptom scores, measured by the original PANSS subscales (Key et. al., 1987)*

| Symptom scores<br>(original PANSS) | Maximum possible<br>score | Mean (SD)          | Range |
|------------------------------------|---------------------------|--------------------|-------|
| <b>Positive symptoms</b>           | 49 (7 items)              | 14,6 ( $\pm 5,1$ ) | 7-32  |
| <b>Negative symptoms</b>           | 49 (7 items)              | 14,5 ( $\pm 6,2$ ) | 8-43  |
| <b>Global score</b>                | 112 (16 items)            | 31,0 ( $\pm 7,6$ ) | 17-69 |

When splitting the file in a “male” group and a “female” group, no significant sex differences were discovered, neither in PANSS nor MASC results. The following bivariate correlation analyses were therefore performed on the whole sample.

## 3.2 Results of bivariate correlation analyses

Results after investigating the associations between symptoms and ToM scores are summarized in Table 6 (Wallwork factors) and Table 7 (original PANSS subscales). Follow-up analyses were performed at sub-level for the undermentalizing error type. These results are presented in Table 8.

**Table 6:** *Correlations between symptoms (Wallwork et. al. 's factors) and ToM variables, presented in rho (p)*

|                                  | <b>MASC<br/>total errors</b> | <b>MASC<br/>undermentalization</b> | <b>MASC<br/>overmentalization</b> |
|----------------------------------|------------------------------|------------------------------------|-----------------------------------|
| <b>PANSS negative</b>            | <i>rho</i> =.10<br>(.46)     | <i>rho</i> =.11<br>(.45)           | <i>rho</i> =.13<br>(.35)          |
| <b>PANSS positive</b>            | <i>rho</i> = .22<br>(.12)    | <i>rho</i> =.14<br>(.31)           | <i>rho</i> = <b>.28*</b><br>(.04) |
| <b>PANSS<br/>disorganization</b> | <i>rho</i> =.22<br>(.12)     | <i>rho</i> =.26<br>(.07)           | <i>rho</i> =.09<br>(.53)          |

\*Significant at the 0.05 level (2-tailed)

**Table 7:** *Correlations between symptoms (original PANSS subscales) and ToM variables, presented in rho (p)*

|                       | <b>MASC total errors</b>  | <b>MASC undermentalization</b> | <b>MASC overmentalization</b>    |
|-----------------------|---------------------------|--------------------------------|----------------------------------|
| <b>PANSS negative</b> | <i>rho</i> =.20<br>(.15)  | <i>rho</i> =.20<br>(.15)       | <i>rho</i> =.17<br>(.22)         |
| <b>PANSS positive</b> | <i>rho</i> = .24<br>(.09) | <i>rho</i> =.09<br>(.52)       | <b><i>rho</i>=.43**</b><br>(.00) |

\*\* Significant at the 0.01 level (2-tailed)

*Hypothesis 1a:*

*There will be a positive correlation between disorganization symptoms and general ToM impairment*

When investigating the relationship between disorganization symptoms and ToM ability, a small correlation was found (*rho*=.22). It did not reach significance (*p*=0.12).

*Hypothesis 1b:*

*There will be a positive correlation between negative symptoms and general ToM impairment*

A small, non-significant correlation was found between the negative symptoms score and the total errors score ( $\rho=.10$ ) when analyzed with Wallwork's factors. A similar result appeared with the original PANSS subscales ( $\rho=.20$ )

*Hypothesis 2a)*

*There will be a positive correlation between negative symptoms and undermentalizing errors*

A small, non-significant correlation was found between the negative symptoms score and the undermentalizing score, as analyzed both with the Wallwork symptom factors ( $\rho=.11$ ) and the original PANSS subscales ( $\rho=.20$ ).

*Hypothesis 2b)*

*There will be a positive correlation between disorganization symptoms and undermentalizing errors*

A small correlation ( $\rho=.26$ ) was found between the disorganization symptoms score and the undermentalizing score. It did not reach significance ( $p=0.7$ ).

*Hypothesis 2c)*

*There will be a positive correlation between positive symptoms and overmentalizing errors*

A small-moderate correlation was found between positive symptoms and overmentalizing ( $\rho=.28$ ). The correlation was significant ( $p=.04$ ). When applying the original PANSS subscales, the correlation was moderate ( $\rho=.43$ ) and significant ( $p=0.0$ ).

As the above presented analyses yielded significant results, a follow-up analysis was performed with the two different error types of undermentalizing. The result shows no significant correlations, although there is a trend-level correlation between disorganization symptoms and the error type “reduced ToM” (.27).

**Table 8:** *Correlations between symptoms (Wallwork et. al.’s factors) and two undermentalization domains using the specified error analysis of MASC*

|                              | <b>MASC reduced ToM</b> | <b>MASC no ToM</b>   |
|------------------------------|-------------------------|----------------------|
| <b>PANSS negative</b>        | $\rho=.16$<br>(.26)     | $\rho=-.07$<br>(.63) |
| <b>PANSS positive</b>        | $\rho=.14$<br>(.31)     | $\rho=.11$<br>(.42)  |
| <b>PANSS disorganization</b> | $\rho=.27$<br>(.05)     | $\rho=.19$<br>(.18)  |

Finally, as shown in Table 9, ToM results were found to have a significant, moderate correlation with IQ ( $\rho=.36$ ).

**Table 9:** *Correlations between IQ and ToM scores*

|                | <b>MASC correct ToM<br/>answers</b> | <b>MASC<br/>undermentalization<br/>errors</b> | <b>MASC<br/>overmentalization<br/>errors</b> |
|----------------|-------------------------------------|---|--|
| <b>WASI IQ</b> | .36** (.00)                         | -.29* (.04)                                   | -.24 (.09)                                   |

\*\*Significant at the 0.05 level (2-tailed)

\*\*Significant at the 0.01 level (2-tailed)

## 4 Discussion

The present study investigated the relations between symptoms in schizophrenia and deficits in ToM performance. A new, video-based instrument to examine social cognition was applied for the first time on a Norwegian sample, and analyses were conducted to assess the association between an empirically derived five-factor structure of symptoms in schizophrenia and ToM ability.

The hypotheses of the study followed along two axes: The three first hypotheses were based on recent literature evidencing correlations between negative and disorganization symptoms and a general ToM deficit. The two last hypotheses had their foundation in Frith's model (2004), claiming that, if using sensitive measure instruments, one can expect to find differential ToM difficulties depending on the person's symptom profile.

The discussion starts with an exploration of the comparability and relevance of the underlying data of this empirical work, before moving on to possible interpretations of the results. Chapters 4.5 and 4.6 broaden the perspective and discuss possible challenges when investigating ToM in schizophrenia as done in this study. Clinical implications of results are outlined, and finally, possible limitations of the study are provided.

### 4.1 Representativeness of the data

#### 4.1.1 Clinical data

In these analyses, Wallwork et. al.'s factor model of PANSS was applied. Because of its recent launching (2012), few studies have yet reported results using it. It was therefore necessary to additionally use the original PANSS subscales in order to compare the symptom data of participants of this study to other samples.

Two relevant studies were Montag et. al.'s study of 80 patients with schizophrenia (2011) and Urbach et. al.'s study of 206 patients with schizophrenia (2013). These patients had higher overall symptom scores compared to the Norwegian sample, with a difference particularly evident with regards to negative symptoms. While our sample presented with a mean negative symptoms score of 14.5, Montag's sample had a mean score of 17.8 and Urbach's sample a mean score of 23.2.

However, the current sample is comparable to other Norwegian schizophrenia studies with regards to symptom levels. For example in Simonsen et. al.s' (2011) study, which was also part of the NORMENT project but with an entirely separate sample ( $n=102$ ), participants had a mean score of PANSS negative symptoms of 15.7.

What can explain the relatively low scores of negative symptoms in the Norwegian samples? One contributing factor may be age. When comparing the mean age level of the participants of this study (28.8 years) to Montag's group (39.1 years) and Urbach's group (42.7 years), the Norwegian participants are considerably younger. Knowing that negative symptoms tend to develop later in the progression of schizophrenia, one possible explanation may be that the two other patient samples were more affected by negative symptoms because their illness has taken a more chronic form where the negative symptoms have become more impairing.

#### **4.1.2 ToM data**

Due to its recency, MASC does not yet have a published standardization. One must therefore turn to other published studies applying MASC to see whether the scores presented in this work are considerably different in any way.

Compared to 80 German patients with paranoid schizophrenia (Montag et. al., 2011), the participants of this study committed fewer ToM errors than German patients. The error analysis revealed that the Norwegian sample achieves lower error scores in all categories, but the difference is highest in the undermentalizing condition "Reduced ToM", where the German patients had a mean score of 9.1, and the Norwegians' mean score was 6.8. It is possible that diagnostic differences between the countries may have affected these results, as Montag's group was paranoid schizophrenia participants only, while our group consisted of



participants with different subtypes of schizophrenia as well as schizoaffective disorder. Whether the ToM scores of this study are representative of a Norwegian schizophrenia population will therefore remain unsettled until more studies have been conducted utilizing MASC in Norway. Work is also in progress at NORMENT to collect MASC data of healthy controls matched to the schizophrenia group.

In sum, when comparing across countries, the Norwegian participants had lower symptom scores and lower ToM error scores than the German participants. These underlying features of the sample might be worth bearing in mind when discussing the results further.

## 4.2 Discussion of hypotheses

### *Hypothesis 1a and 2a: Disorganization symptoms*

Hypotheses 1a and 2a both concerns disorganization symptoms and ToM performance. A small, non-significant, correlation ( $\rho=.22$ ) was seen between disorganization symptoms and general ToM ability using the total error score of MASC. The error analysis revealed a trend-level correlation of  $\rho=.26$  between the error category “undermentalizing” and disorganization symptoms, while the correlation is much weaker with regards to “overmentalizing” ( $\rho=.09$ ). This tendency corroborates evidence for an association between disorganization symptoms and ToM difficulties. More specifically, it seems like the association is strongest between undermentalizing problems and disorganization symptoms, in line with Frith’s hypothesis. However, the correlation is not significant, and the strength of the association suggest there are also other factors playing important roles in the relation between ToM ability and disorganization symptoms.

MASC also provided the possibility to do further sub-analyses of the undermentalizing domain. When separating the undermentalizing error types into “Reduced ToM” and “No ToM” (Table 8), a correlation of  $\rho=.27$  was found between “Reduced ToM” and disorganization ( $p=0.5$ ). The correlation was weaker with regards to “No ToM” ( $\rho=.19$ ). One interpretation of this finding may be that undermentalizing problems, when seen with

disorganization symptoms, are best understood as reduced ToM ability, not as lacking the ability entirely (see also 4.5 for a further discussion of ToM accuracy versus ToM capacity).

It is also worth noticing that disorganization symptoms may be measured in quite different ways in the literature. Wallwork et. al.'s (2012) factor structure of symptoms, which has been applied in this study, leaves the disorganization factor with only three of the original PANSS items. This is considerably less than other, comparable factor analyses like e.g. van der Gaag et. al.'s model (2006), which includes nine items in the disorganization factor. Several of the items left out by Wallwork et. al. are general psychopathology items, like "G10: Disorientation" and "G12: Lack of judgment and insight". The original PANSS model does not have a disorganization subscale, but sometimes single items like "P2: Conceptual disorganization" are applied in analyses of disorganization. Which items are included might play an important role when analyzing disorganization symptoms in this field and comparing results with other studies.

#### *Hypotheses 1b and 2b: Negative symptoms*

Hypotheses 1b and 2b are both assessing negative symptoms and ToM performance. Negative symptoms in our sample were not significantly associated with neither the total MASC error score nor the specific score of undermentalizing errors. The results were by large the same with Wallwork's symptom factors and the original PANSS subscales. This is in contrast to results from other recent studies in the field (hypothesis 1b), and Frith's expectations (hypothesis 2b).

The explanation for the results may derive from different sources. The most obvious one is that there is in fact no such relation – that negative symptoms and ToM difficulties exist independently of each other. This would be in line with the claim that negative symptoms and social cognition are indeed separate domains (e.g. Rassovsky et. al., 2011).

It could, however, be relevant to take into account the earlier mentioned analyzes of symptoms in this sample compared to other patient samples. It was evident that the participants of this study had a considerably lower negative symptom score than both Montag's group and Urbach's group. The undermentalizing scores were also lower in this

study than in Montag's sample. These systematic differences may have affected the results, although some associations would still be expected.

The variability of the data in statistic terms may also have affected the correlation sizes in the relation between negative symptoms and undermentalizing. The standard deviations of both negative symptoms and undermentalizing scores were somewhat lower in the current sample compared to e.g. Montag's (2011) sample. The value of the correlation will be greater if there is more variability among the observations (Goodwin & Leech, 2006).

There are other examples of studies where no correlation between negative symptoms and impaired ToM has been found. Pousa et. al. (2008b) revealed no such association, but when IQ and illness duration were removed from the covariates, the relationship reached significance for the most advanced of the ToM tasks in the study. The authors therefore suggest that ToM deficits when observed in patients with negative symptoms may be less specific and accounted for by general cognitive impairment and illness chronicity (Pousa et. al., 2008b). This is an explanation not assessed in the present study.

### *Hypothesis 2c*

The strongest finding of this study is the significant correlation seen between positive symptoms and overmentalizing ( $\rho=.28$ ). The association was even stronger when analyzing the data with the original PANSS subscales ( $\rho=.43$ ). Few studies have found such an association earlier (Freeman, 2007; Urbach et. al., 2013), and in this aspect, the result may be seen as somewhat surprising. However, it is in line with Frith's hypothesis of the existence of differential ToM impairment among persons with schizophrenia which are detectable with sensitive instruments only. It also corroborates the evidence found in Montag et. al.'s study (2011), where a similar association was found using the same ToM measure.

What mechanisms may be active when persons struggling with positive symptoms perform differently from persons with predominantly negative symptoms with regard to ToM ability? Abu-Akel and Bailey (2000) proposed the notion of a "hyper-theory of mind" relevant to the positive symptoms group. According to the authors, ToM ability should be view upon as a continuum, reaching from (a) persons having no representational understanding of mental states, through (b) persons having representational understanding of

mental states but a deficit in applying it, to (c) persons having a representational understanding of mind and applying it, but in an atypical manner; overattributing mental states or overgenerating hypotheses about mental life (“hyper-theory of mind”). This leaves the classic dichotomous tests of ToM (presence or absence of mentalization) inadequate in distinguishing between the reasons why people fail to answer belief questions accurately (Abu-Akel & Bailey, 2000).

In this perspective, the association found in the positive symptoms group of the present study may be due to MASC succeeding in detecting differences between the ToM errors performed by participants. Because persons with high scores on positive symptoms may tend to perform a more limited type of errors (overmentalization), it is possible that association between symptoms and ToM deficits may be masked in studies with dichotomous error categories (right/wrong ToM). As Urbach (2013) also notes, the contrasting results in the literature regarding positive symptoms may be due to differences in methodology, a view supported by this study. If this turns out to be a trend found in more studies, a consequence may be the necessity of applying ToM tests which are able to discriminate between over- and undermentalizing in schizophrenia studies to get a more complementary picture of the associations to symptoms.

## **4.3 The trait or state debate**

The next question is how the results of the present study fit into the “trait or state” debate. As mentioned earlier (see 1.4.1), there is an ongoing controversy in the field on whether ToM impairments may be seen as a trait marker in schizophrenia, or if they rather are related to particular symptoms and therefore more state dependent. The results presented in this empirical work lend support to both viewpoints.

The lack of correlations with regards to negative symptoms may support a trait view, where ToM impairment operates independently from symptoms. Among our fifty-two participants, there does not seem to be any connection between the severity of negative symptoms and the degree of ToM impairment. Perhaps ToM ability per se does not relate to

negative symptomatology, opposite to Frith's belief. Such an interpretation of the findings will strengthen evidence for ToM deficits in schizophrenia to be a distinct feature, unaffected by the person's changing symptom status.

On the other hand, the findings on positive symptoms are an argument for a state viewpoint. One can in the current study see a significant co-variance between the severity of symptoms like delusions, hallucinations and unusual thought content, and a decrease in ToM performance due to overmentalizing errors. This is in line with e.g. Pousa et. al.'s (2008b) research, where specific ToM deficits were found to be associated with delusions, and associations with negative symptoms were accounted for by illness chronicity and general cognitive impairment. A thorough meta-analysis of 73 studies (Ventura et. al., 2009) is interesting in this aspect. Ventura et. al. found that negative symptoms were significantly related to neurocognitive functioning, whereas positive symptoms were not. Pousa et. al. argue that results like these add to evidence for mentalizing deficits seen in delusional patients reflecting a genuine problem in forming representations of others' intentions, while the ones seen in association with negative symptoms could to a greater extent be explained by general cognitive impairments.

Turning again to Frith, a model where a differential deficit in ToM is evident would be able to explain the results of this study in light of the trait or state debate. It may seem like a shortcut to automatically ascribe ToM errors due to "overmentalizing" and ToM errors due to "undermentalizing" to the exact same cognitive deficit, even if the diagnosis of participants is the same. As Freeman (2007), in his literature review of the psychology of persecutory delusions, remarks: "Many paranoid individuals would say that their persecutors are not disguising their intentions, and indeed make their intent all too clear". It therefore seems fair to suggest that Frith's hypothesis (2004) receives partial support from this study.

Based on this, one may ask whether it is useful to see ToM impairments as *either* trait *or* state dependent. The findings of this study might suggest that ToM impairments associated with positive symptoms (overmentalizing) could be partly state dependent, and ToM problems due to undermentalizing could be better explained from a trait view. This would support Montag's (2012) point that perhaps only *undermentalizing* is a trait marker in schizophrenia.

To get a more comprehensive picture of the trait or state question, it seems necessary to conduct longitudinal studies to assess ToM performance in the same persons through different stages of their disease. Drury et. al. (1998) found in a longitudinal study that their schizophrenia patients, who reported a multiplicity of positive and negative symptoms, performed significantly worse than patients with other psychotic disorders, delusions or depression on ToM tasks during an acute episode. However, at recovery there was no significant difference between groups in performance on any of the tasks. Harrington, Siebert and McClure conclude in their review of ToM in schizophrenia (2005) that firm conclusions in the state or trait debate cannot be drawn because of the absence of robust longitudinal studies on this question. It would be interesting to assess the symptoms and MASC performance of the participants in the present study again at a later point to see if changes in symptoms and developments in the disease would predict changes in their ToM ability.

## 4.4 ToM and IQ

As shown in Table 9, there was a significant correlation ( $\rho=.36$ ) between general ToM ability and IQ in our sample. IQ, executive functions and memory abilities seem to be correlated with ToM performance of persons with schizophrenia, and association of this size are frequently found (Bora et. al., 2009). Some have found ToM deficits to be a component of impairments of general intellectual ability (Pentarakis et. al., 2012). However, several reviews suggest that cognitive deficits and IQ cannot explain ToM impairment fully (Brüne, 2005; Harrington et. al., 2005), and Sprong et.al.'s meta-analysis (2007) reported that IQ did not affect mean effect sizes for ToM impairment.

A moderate correlation between ToM performance and IQ, as seen in this study, could therefore be expected, and is in line with evidence that social cognition is associated with neurocognition but not redundant with it (Green & Horan, 2010).

## 4.5 ToM accuracy versus ToM capacity

MASC allows for a distinction between the undermentalizing categories “Reduced ToM” and “No ToM”. This distinction can be exemplified by a scene from MASC:

The host, Sarah, has burned the cake she planned for dessert. With great despair, she reveals this to her first guest, Knut. There is a bowl of chocolate cookies at the table in front of them. Knut reaches out for a cookie and says with a kind, calming smile to Sarah: “To be honest, I’m not too fond of cake. But I really love chocolate cookies!” Sarah is clearly relieved by his comment. Now, the movie is stopped, and the participant is asked why Knut is saying this. The alternatives for answering are:

- a) To cheer Sarah up (correct ToM)
- b) Because he is very attracted to Sarah (overmentalizing)
- c) Because he is not too fond of cake (reduced ToM)
- d) Because there are chocolate cookies at the table (no ToM)

One can hypothesize that persons committing many “No ToM” errors have a more severe ToM impairment than those with many “Reduced ToM” responses, because they may seem to lack the construct of another person’s mind – a missing ToM capacity. Such an impairment might perhaps be regarded similar to the “mind-blindness” seen in autistic disorders. Although no significant differences were revealed in the sub-analyses of error types in the present sample (Table 8), some interesting trends were found, like the correlation ( $\rho=.27$ ) between “Reduced ToM” and disorganization. The correlation was weaker with regards to “No ToM” ( $\rho=.19$ ). Being able to do this distinction between accuracy and capacity can be interesting when trying to understand ToM impairments in schizophrenia.

The importance of this distinction is in focus in the capacity-oriented view discussed by Roberts and Pinkham (2013). This perspective implies that quantifying social cognitive capacity in terms of accuracy (e.g. right/wrong ToM answer) may be less fruitful than exploring whether a person has the ability to generate and manipulate social cognitive representations at all, regardless of accuracy. According to Roberts and Pinkham, such a viewpoint would recommend using the term “social cognition *deficit*” only when people fail to generate mental state attributions at all (lack of capacity), not when their representations are

inaccurate or unusual. As they point out, no one, with or without schizophrenia, can tell *for sure* what goes on in another person's mind. Accuracy problems might therefore be regarded as part of healthy human cognition. Investigating more closely what recognizes persons performing more "reduced ToM" answers versus those who make more "no ToM" responses could be interesting, both with regards to this study's participants, but also with the inclusion of MASC data from healthy control persons.

## **4.6 Generalizability of MASC results to real-life situations**

The participants of the present study were placed in front of a computer in an office, together with the test administrator. He or she watched a movie about four friends, and, as the movie was paused, the participant tried to imagine what the persons in the movie were thinking, feeling or intending. Even if the aim of this study was not to see whether MASC results predicts social functioning, it is still a timely question to ask whether the results of a task like this are relevant to how the participant will manage social situations out in the real world.

McCabe, Leudar and Antaki (2004) tried to shed some light on this issue. They recorded 35 encounters between mental health professionals and people with schizophrenia, and used conversation analysis in order to identify how the participants used or failed to use ToM relevant skills in social interaction. The patients all presented with ongoing positive or negative or a combinations of symptoms. Analyses revealed that the patients appropriately reported mental states of others, designed their contributions to conversations on the basis of what they thought their communicative partner knew and intended, and recognized that others did not share their delusions. Although not correlated with standardized measures of ToM ability, the study is an interesting reminder to the field, and it underlines the importance of applying measures that resembles real-life situations as well as possible. Video tasks with professional actors are a step in this direction (Mehl, 2010). However, further studies using tests like MASC will hopefully address the question of ecological validity more systematically.



Similarly, Stanghellini and Ballerini (2011) criticized ToM paradigms for not properly investigating real-world functioning in persons with schizophrenia. In their view, studies on social cognition in schizophrenia sidestep the experiential quality of conscious mental life and are committed to an idea of cognitive functioning depicted as an input-output device based only on its processing properties. They argued for the need to collect ToM data through qualitative as well as quantitative methods to get more insight into the subjective experience of dissociality; to really assess *what it is like* to be a person with schizophrenia in the social world. Following this thought, it would, for example, be very interesting to have additional qualitative data on how the participants of the present study were reasoning when answering to the MASC questions, as this would give a more comprehensive insight into the mental process of ToM.

Intriguing is also Abu-Akel and Shamay-Tsoory's remark (2013, p. 202) on the fact that the overwhelming majority of ToM measures in schizophrenia, also MASC, are focusing on ability to represent and attribute mental states of *others*. This happens despite the recognition that studying the ability to attribute mental states to one's self is important to understanding schizophrenia. The concept of self-disorders, defined as "subtle disturbances of a person's spontaneous experience of himself or herself as a vital subject, naturally immersed in the world" (Parnas and Handest, 2003), is receiving interest in schizophrenia research. A recent Norwegian study found a significant association between suicidality and level of self-disorders, mediated by depression, among people with schizophrenia, (Haug et. al., 2012). Taken together, this could give rationale for the importance of clinically targeting self-experience and self-representations in schizophrenia, in addition to the current focus on being able to attribute the mental states of others.

## 4.7 Implications for treatment

The detailed error analysis of the present study revealed some associations between specific ToM errors and symptom profiles. With regards to positive symptoms, results showed a significant co-variance with overmentalizing. This means having a tendency excessively attribute intentions or self-referential meaning to others, and therefore predict behavior on the basis of wrong beliefs. In the presence of symptoms of disorganization, on the other hand, a

tendency of undermentalizing was observed. The answers of participants in this category typically reflected a reduction or lack in the ability to understand other people's intentions, thoughts or feelings. Added together with other recent research contributions in the field indicating similar differentiations (Montag, 2011), one might ask if the implication of such differential ToM dysfunction is that differential treatment approaches should be recommended to patients, according to their symptom profile.

Social cognition treatments are still relative newcomers to the field of psychosocial rehabilitation in schizophrenia (Fiszdon, 2013). Even though cognitive and metacognitive treatment approaches targets cognitive biases supposedly involved in delusions formation, and e.g. metacognitive treatments explicitly aim to foster improved ToM (Moritz et. al., 2013), specialized training programs are not yet standard routine in most of the treatments received by persons with schizophrenia. In Norway, NORMENT is currently running a research project where social cognition training is in focus, but there is no strong tradition yet to include such training in standard schizophrenia treatment.

That means that the first step perhaps should be to increase awareness around social cognition as an important target for treatment among professional health workers. Evidence for specific associations between symptoms and differential ToM ability is emerging, but reported results are still mixed, and it is therefore preliminary to claim that certain treatment approaches should be preferred to others on the basis of symptom assessment at this point. One must also note that many people with schizophrenia often display both positive, negative and disorganization symptoms simultaneously, and in these cases, such a differentiation is difficult. Additionally, symptoms can be changing within the same individual. Pending more knowledge, one can hypothesize training programs aiming to enhance ToM ability in general to have an effect in this patient group, regardless of whether the person's main challenge is over- or undermentalizing. These exact mechanisms remain uncharted territory in the field.

## 4.8 Limitations of the study

One important limitation of the present study is that results are not controlled for some possibly confounding variables, including executive functioning, IQ measures and social functioning. Non-parametric measures of significance like Spearman's rho do not facilitate valid partial analyses, and they have therefore not been implemented on this sample. However, as discussed in 4.3, ToM deficits are believed to have an independent role despite of correlations with IQ. With regards to executive function, a review of 17 relevant studies concludes that ToM and executive function impairments in schizophrenia are independent of one another (Pickup, 2008).

It could also be noted that these possibly confounding variables would be even more important to control for if one were examining differences between a patient group and a control group, where differences on these variables would be expected. Data is continuously being collected in the NORMENT project, and perhaps a larger sample will yield the possibility to do partial analyses on these same hypotheses at a later point, preferably also with the inclusion of a control group.

Another limitation of the study is the lack of knowledge on detailed psychometric properties of the Norwegian version of MASC. Since this is the first empirical work applying the Norwegian MASC, we do not yet know e.g. how well it differentiates patients from controls in Norway, although preliminary analyses show promising results. It will also be interesting to see how MASC performance in Norway relates to relevant domains like social functioning and other measures of functional outcome. Expected articles from NORMENT will illuminate this issue further.

A third limitation concerns medication. Most of the participants of the study were on medication (see Table 1), and several studies have concluded that ToM performance is influenced by what kind of antipsychotic patients have taken (e.g. Savina & Beninger, 2007). Different symptomatology might systematically have affected the specific types of medication the participants of this study were given, and this might therefore have influenced results.

Finally, it is also important to notice the strengths of the correlations of the study. Although significant, the association between positive symptoms and overmentalizing was only small-moderate, leaving a lot of the variance between the two variables to be explained

by other factors. This is in line with research stating that symptoms and social cognition are two separate constructs in schizophrenia, although there are indications for some overlap. This potential overlap between symptom profile and ToM style might be interesting to explore further in future research. It also seems fruitful to use more sensitive ToM measure instruments to gain better insight in these mechanisms. In sum, the study adds evidence for ToM functioning in schizophrenia to be part of complex processes that hardly can be explained by direct, causal variables, but can be understood better with appropriate measures.

## **4.9 Conclusion**

The aim of the study was to investigate the relationship between symptoms and ToM function in persons with schizophrenia. No significant associations were found between negative symptoms and undermentalizing or disorganization symptoms and undermentalizing. Positive symptoms were, however, found to have a moderate, significant correlation with overmentalizing, and this hypothesis was therefore supported. Results may indicate that only overmentalizing problems are state dependent in schizophrenia, whereas undermentalizing may be more of a trait marker. The findings also call for the use of more error sensitive measures when investigating ToM in schizophrenia in order to get a more comprehensive understanding of each patient's treatment needs.

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